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A revision of the Middle Devonian uncinulid brachiopod genus *Beckmannia* Mohanti, 1972, and its distribution.

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SYNOPSIS. The Middle Devonian uncinulid brachiopod from Burma previously identified as *Markitoechia*? cf. *pentagona* (Kayser, 1871) is revised and assigned to *Beckmannia* Mohanti, 1972, and the new species *B. padaukpinensis*. A Givetian age for *Beckmannia* is favoured. This genus shows biogeographical affinities with the Rhenish–Bohemian Region of the Old World Realm and particularly of the Rhenish faunal province that extended into Burma and China.

INTRODUCTION

Anderson *et al.* (1969) described a rich collection of brachiopods from the Padaukpin limestones, in the Northern Shan States of Burma, as Eifelian in age. While examining this collection at the British Museum (Natural History) (BB 55500–89), we found that an uncinulid brachiopod described and figured (1969: 139-40; pl. 6, figs 1-4; text–fig. 4) as *Markitoechia*? cf. *pentagona* (Kayser, 1871) was in need of revision. This note deals with the taxonomic revision and comments on the stratigraphical and palaeo-biogeographical distributions of the uncinulid genus *Beckmannia* Mohanti, 1972.

SYSTEMATICS

Mohanti (1972: 166–7) erected the genus *Beckmannia*, with *Uncinulus minor beckmanni* Schmidt, 1951 as the type species, and assigned some Spanish uncinulids to the same taxon. It now appears it might not have been correct procedure to make a subspecies the type of a new genus (Mohanti 1972: 166); the subspecies should first have been elevated to a species. Although the typical subspecies *Uncinulus minor minor* (Schnur) has not been re-examined by us, as explained below we now believe that *U. m. beckmanni* Schmidt is not even the same genus as *U. m. minor* (now ascribed to *Kransia* Westbroek), and should have been cited as *Beckmannia beckmanni*.

The external characteristics of *Beckmannia* agree closely with the description given by Anderson *et al.* (1969) for their *Markitoechia* species, and our own examination of the Burmese specimen (BB 55550, Anderson *et al.* 1969: pl. 6, figs 1–4) (Fig. 1a–e herein) leads us to the opinion they are congeneric.

The three serial sections (Z–1, Z–2, Z–3) of specimen BB 55589C, and its remaining cut surface (marked as N), were examined and are refigured here (Figs 2a–d). The differences between our figures and the figures of serial sections presented by Anderson *et al.* (1969: 139, fig. 4) are clear. In ours the ventral valve has two thin dental plates supporting the teeth, and in the dorsal valve the hinge plate is divided. The median septum is thin and does not support the hinge plate anteriorly. Serial sections of a topotypic specimen of *Beckmannia beckmanni* from Germany (Mohanti 1972: 167, fig. 26 (see Fig. 3 herein); 168, fig. 27), displayed the presence of a cardinal process posteromedially (Fig. 3a). In his original description of *Beckmannia* Mohanti (1972) drew attention to structures associated with the crural bases observed on the 'peels' of serial sections taken from his Spanish specimens (1972: 166, fig. 25). These were referred to as 'an elevated and bilobate cardinal process . . . ' We believe *Beckmannia* has a true apical, striated cardinal process (Fig. 3a), but the structures associated with crural bases should not be termed a

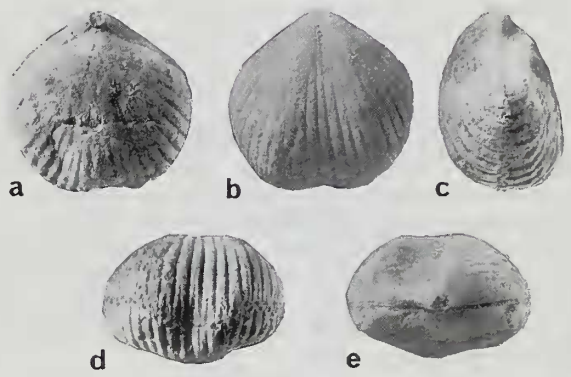

Fig. 1a–e Dorsal, ventral, lateral, anterior and posterior views respectively of specimen BB 55550, from Middle Devonian of Padaukpin, Burma. **Holotype** of *Beckmannia padaukpinensis* sp. nov. Figs 1d, e with dorsal valve at bottom. All × 4.

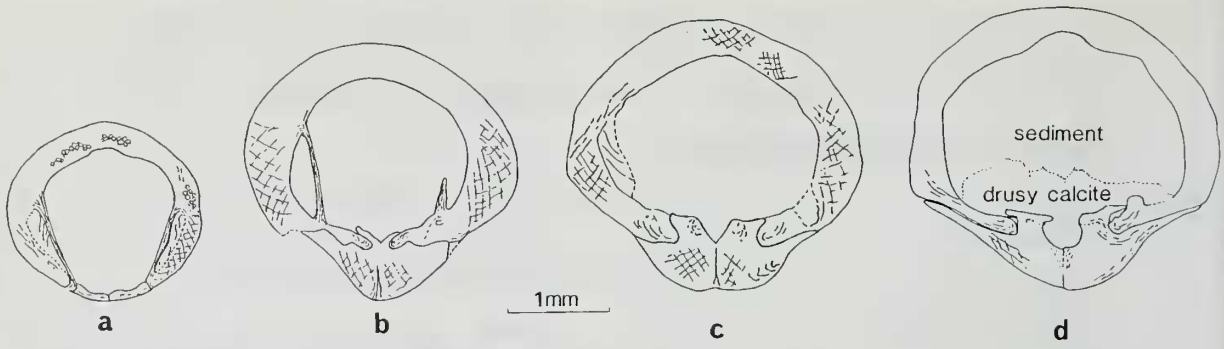

Fig. 2a–d Serial sections × 24 of *Beckmannia padaukpinensis* sp. nov. (called by Anderson *et al.* (1969) 'Markitoechia? cf. *pentagona*'), redrawn using camera lucida from the original 'peels'. (BB 55589C). d = specimen surface N.

cardinal process. Neither the topotype German nor Burmese sectioned specimens display the structures and we now believe it possible that they are no more than representations on the 'peels' of calcite crystals. Thus on examination the internal characters of the Burmese material agree closely with those of the type species of *Beckmannia* and the internal characters of the Spanish specimens assigned to the genus *Beckmannia* (Mohanti, 1972).

During his investigations of uncinulids from the Eifel area of Germany, Westbroek (1967, Enclosure–1) included the typical subspecies '*Uncinulus minor minor*' (Schnur, 1853) (see Schmidt, 1941, 1951) in his new genus *Kransia*, observing that it has a continuous hinge plate; he indicated its range as within the upper Eifelian–Givetian interval. However, as pointed out by Mohanti (1972: 160, 167), this taxon needs further investigation before assigning it to a genus or a stratigraphical range. We believe, however, that the two forms are not even congeneric and should be given full species status, viz. *Beckmannia beckmanni* (Schmidt, 1951) and *Kransia? minor* (Schnur, 1853). *B. beckmanni* is not conspecific with the Burmese specimens so, for the latter, we propose a new species, below.

Beckmannia padaukpinensis sp. nov. Fig. 1a–d

? 1908 *Rhynchonella (Hypothyris) pentagona* (Goldfuss); Reed: 91; pl. 14, figs 15, 15a–b.

1969 *Markitoechia?* cf. *pentagona* (Kayser, 1871); Anderson *et al.*: 139–140; pl. 6, figs 1–4.

HOLOTYPE. BB 55550 from the Padaukpin Limestone, Padaukpin, about 10 miles NE of Maymyo, Central Burma. First satisfactorily illustrated by Anderson *et al.* (1969), above.

DIAGNOSIS. *Beckmannia* with costae and ventral sulcus originating within first 3 mm of growth and having a clearly differentiated sulcate anterior commissure.

COMMENT. The type species, *B. beckmanni*, has costae originating only after about 6 mm of growth and the commissural folding is weak. In other respects the two species are closely comparable.

STRATIGRAPHICAL AND PALAEOBIOGEOGRAPHICAL DISTRIBUTIONS

The type specimens of the type species of *Beckmannia* came from the Upper Givetian 'Flinzkalk' on the east side of the Rhine River near Letmathe, Germany (Schmidt 1951: 89). Mohanti (1972) favoured a Lower Givetian age for *Beckmannia beckmanni* in the context of the general biostratigraphy of the Portilla Limestone Formation of the southern Cantabrian Mountains, Spain, where the Eifelian–Givetian boundary was shown to occur in the Alba syncline.

Ficner & Havlíček (1978: 69) have recorded two species of

Fig. 3a–d Selected serial sections × 21 of *Beckmannia beckmanni* (Schmidt); topotypic specimen from Germany (Mohanti 1972: fig. 26).

Beckmannia from the late lower Givetian brachiopod assemblages at Čelechovice, Moravia, Czechoslovakia. Sapelnikov *et al.* (1987), while dealing with the Upper Silurian–Middle Devonian brachiopods of the eastern slope of the northern Urals, U.S.S.R., described *Beckmannia angularis* (Phillips 1841) as possibly of Emsian age. If they are right in identifying their Urals specimens as *Terebratula angularis* Phillips, (1841: 89; pl. 35, figs 162a–c), then the British species must also be a record of *Beckmannia*.

This revised occurrence of the uncinulid genus *Beckmannia* in Burma is from an assemblage of brachiopods generally considered as of Eifelian age (Reed 1908, Anderson *et al.* 1969). However, Anderson *et al.* (1969: 117), on admittedly somewhat inadequate evidence derived from the study of specimens of the conodont *Polygnathus*, suggested a correlation of the Burmese occurrences with the Upper Eifelian to Lower Givetian strata of central Europe. Mohanti & Gupta (1987) suggested the possibility of an Eifelian–Givetian boundary within the Padaukpin Middle Devonian strata. A Givetian age for the principal occurrences (Fig. 4) of *Beckmannia* is favoured.

Beckmannia is a rhynchonellid brachiopod having biogeographical affinities with the Rhenish–Bohemian Region of the Old World Realm (Boucot 1975). Struve (1982*a*) favoured the terms Rhenish, Bohemo, Hercynian etc. as restricted to faunal provinces. Information from brachiopods indicates that the Rhenish–Bohemian Region of the Old World Realm extended from parts of the European marine depositional basins eastwards as far as Burma and China (Anderson *et al.* 1969, Zhang Yan 1985, Mohanti & Gupta 1987), while Struve (1982*b*), working on data from well-known European regions, has provided a clear picture of the southeasterly extension of the Middle Devonian 'Rheno-Ardennic' brachiopod biogeography.

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Fig. 4 Givetian palaeogeographical reconstruction (after Scotese & McKerrow, 1990) showing the distribution of known occurances of *Beckmannia*. 1 = type area, Eifel region, Germany; 2 = Celechovice; 3 = Cantabrian Mountains; 4 = Padaukpin, Burma; 5 = northeastern Urals.

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